AOS: Status Report

Jan 14, 2013

THE DARK ENERGY SURVEY

AOS

- Adaptive Optics System
  - Measures the wavefront error
    - Donut analysis from 8 wavefront sensors.
    - Calculates defocus (dz), decenter (dx,dy) and tip/tilt (xt,yt)
  - For most of SV only dz has been under active control (correction sent to hexapod)

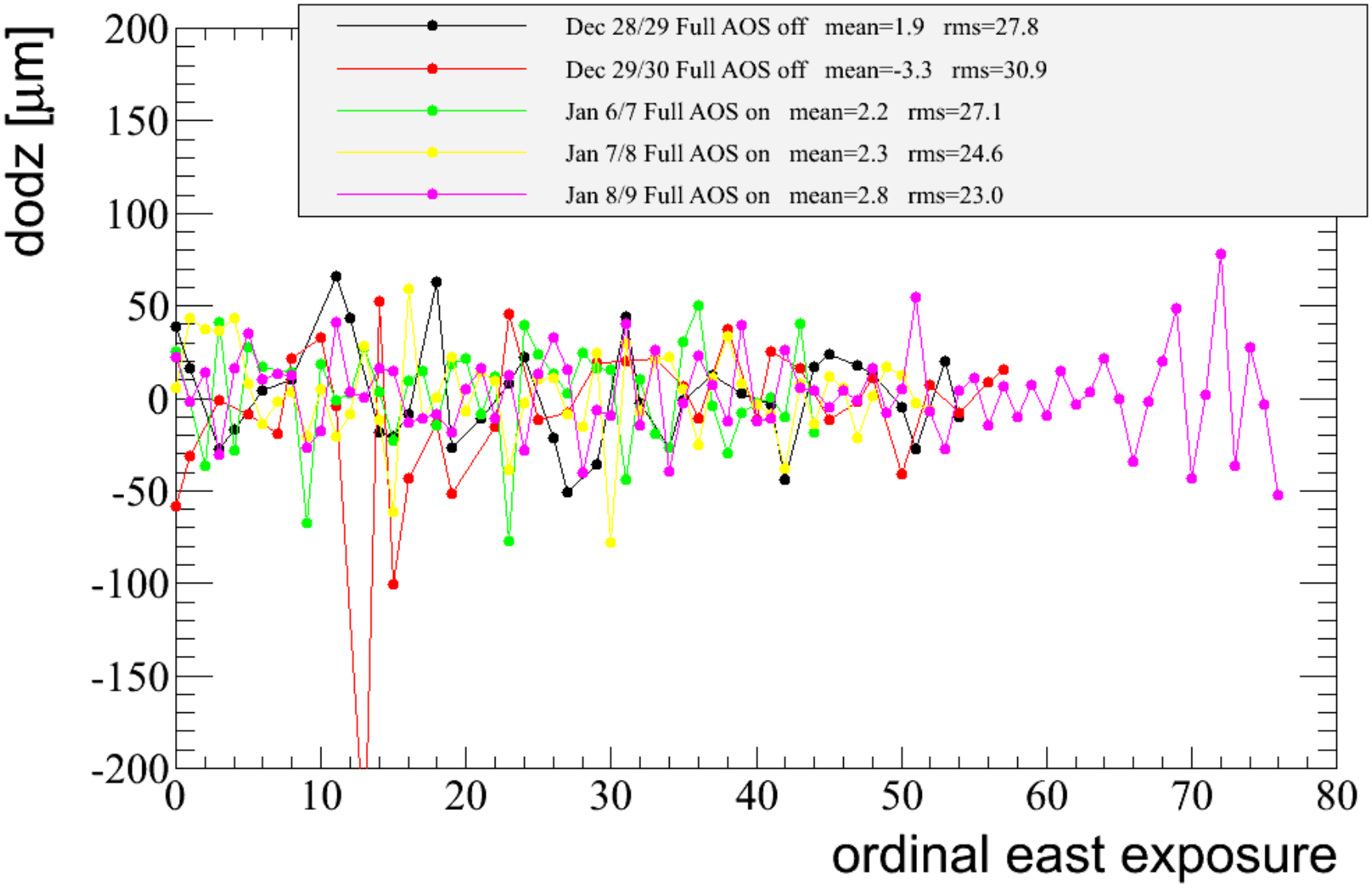
AOS – full active control

- Full active control of all 5 degrees of freedom has had brief tests in the past.
- For several nights in early January, closed loop control on all 5 d.o.f. was enabled.

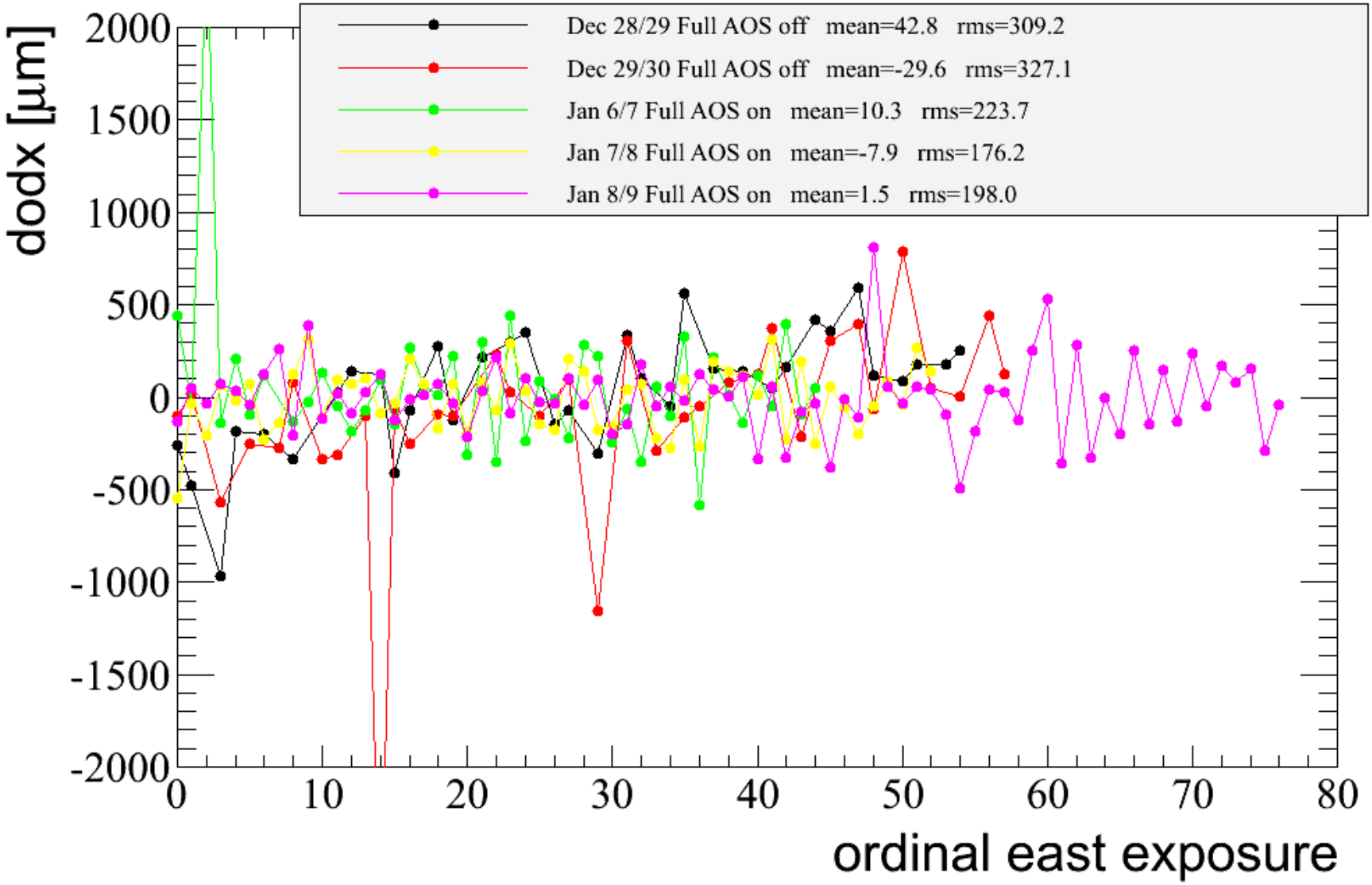
5 nights presented

- For an apples to apples comparison, 5 nights of data with comparable seeing were selected.
  - First two nights Dec 28 and 29 were dz only
  - Next three nights Jan 6, 7 and 8 were full AOS.
- Selected out only period of time each night when east_commish data was being collected.
  - Small slews, excellent control of all 5 d.o.f.

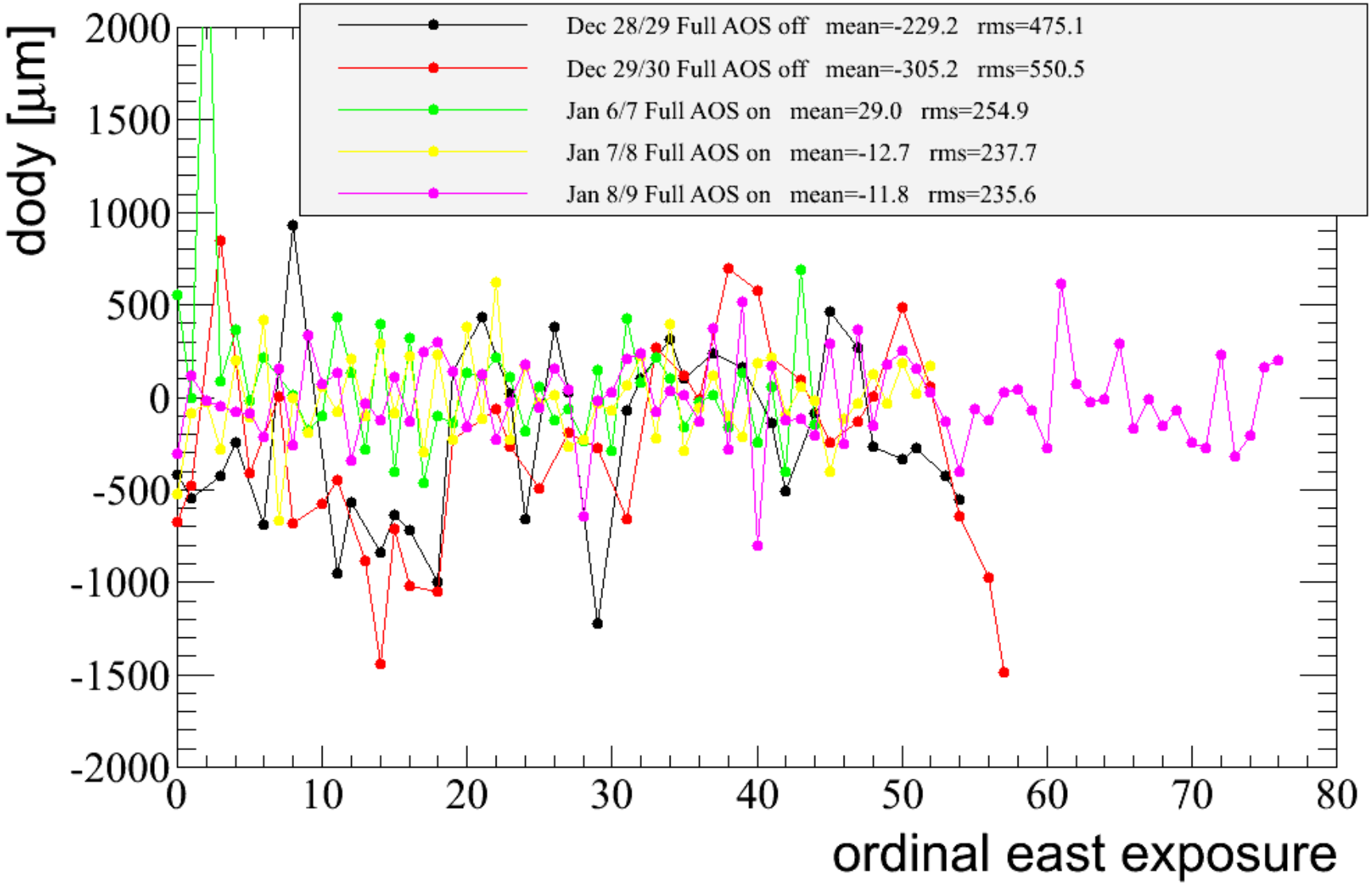
dz (focus)


Dec 28/29 Full AOS off mean=1.9 rms=27.8
Dec 29/30 Full AOS off mean=-3.3 rms=30.9
Jan 6/7 Full AOS on mean=2.2 rms=27.1
Jan 7/8 Full AOS on mean=2.3 rms=24.6
Jan 8/9 Full AOS on mean=2.8 rms=23.0
dodz [µm]
200
150
100
50
0
-50
-100
-150
-200
0
10
20
30
40
50
60
70
80
ordinal east exposure

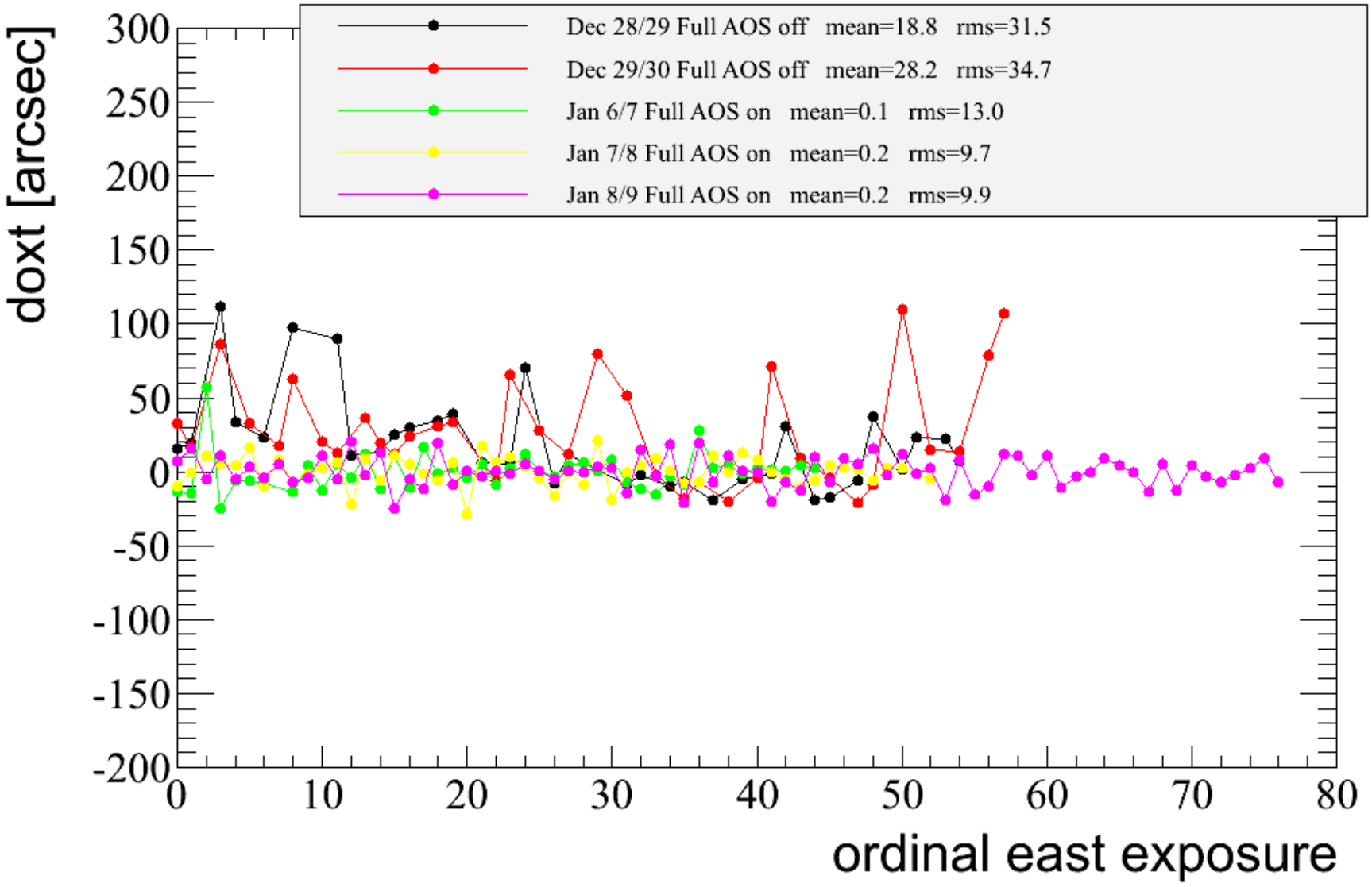
dx (decenter)


Dec 28/29 Full AOS off mean=42.8 rms=309.2
Dec 29/30 Full AOS off mean=-29.6 rms=327.1
Jan 6/7 Full AOS on mean=10.3 rms=223.7
Jan 7/8 Full AOS on mean=-7.9 rms=176.2
Jan 8/9 Full AOS on mean=1.5 rms=198.0
dodx [µm]
2000
1500
1000
500
0
-500
-1000
-1500
-2000
0
10
20
30
40
50
60
70
80
ordinal east exposure

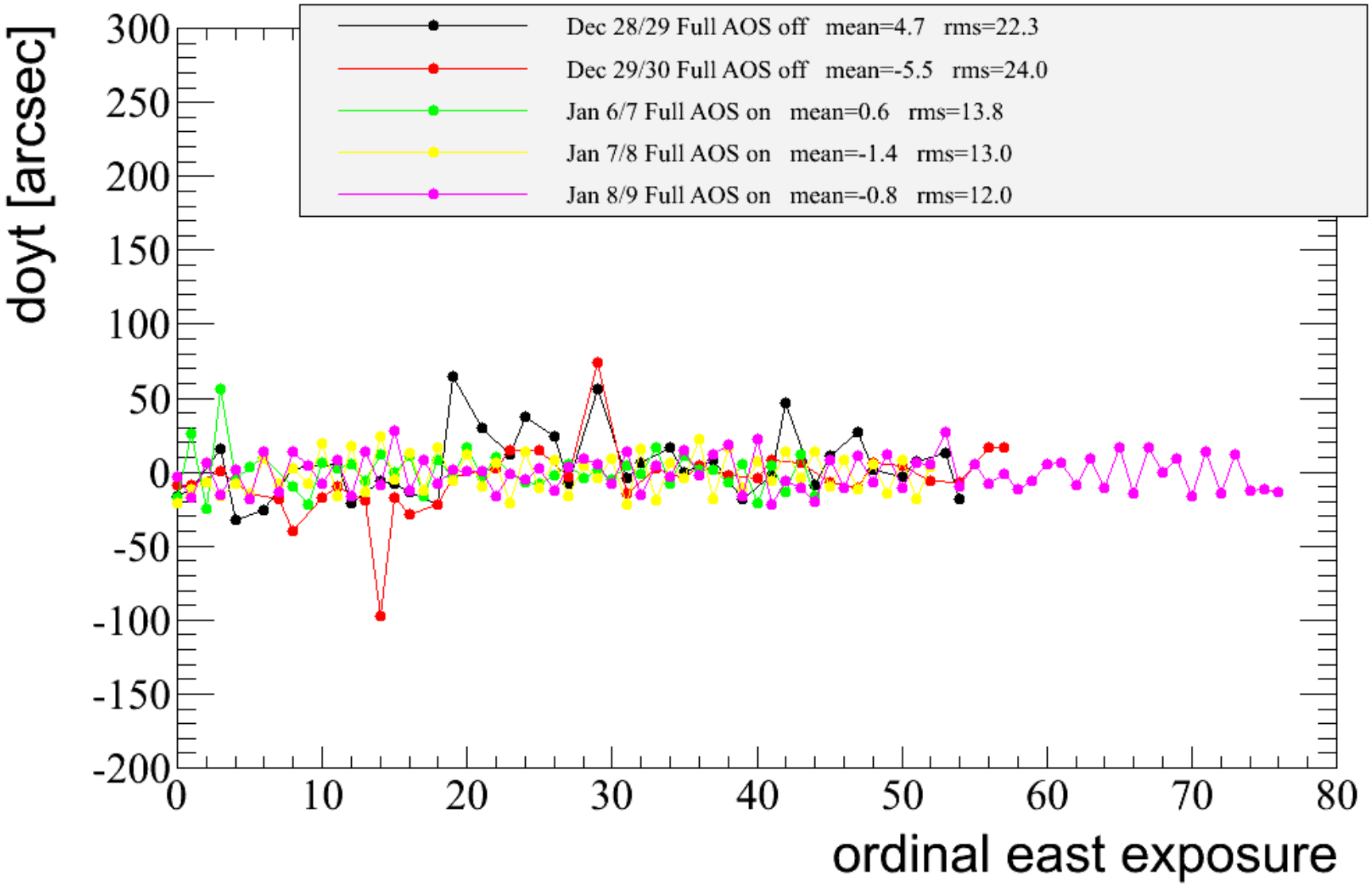
dy (decenter)


Dec 28/29 Full AOS off mean=-229.2 rms=475.1
Dec 29/30 Full AOS off mean=-305.2 rms=550.5
Jan 6/7 Full AOS on mean=29.0 rms=254.9
Jan 7/8 Full AOS on mean=-12.7 rms=237.7
Jan 8/9 Full AOS on mean=-11.8 rms=235.6
dody [µm]
2000
1500
1000
500
0
-500
-1000
-1500
-2000
0
10
20
30
40
50
60
70
80
ordinal east exposure

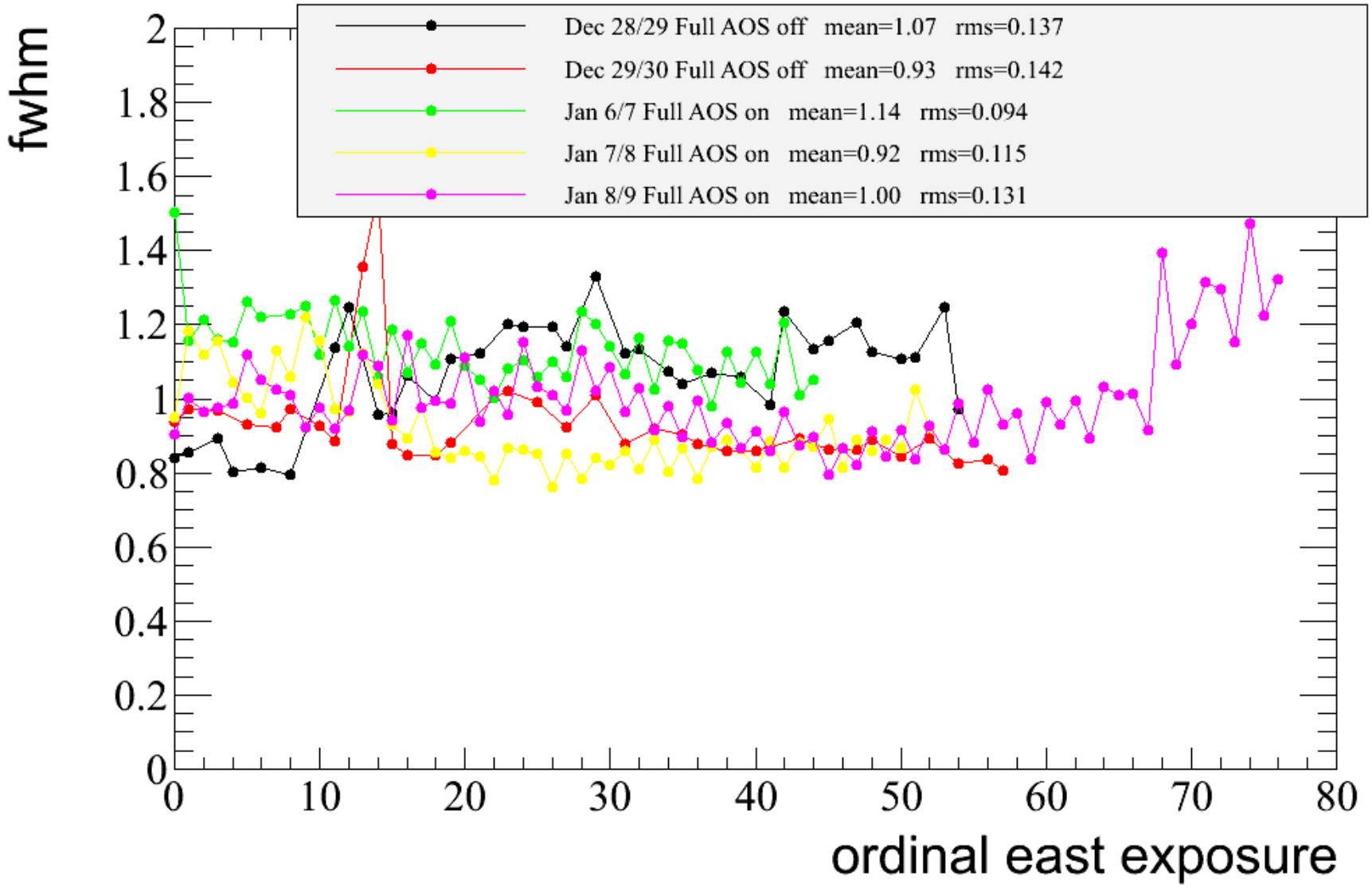
xt (tip)


Dec 28/29 Full AOS off mean=18.8 rms=31.5
Dec 29/30 Full AOS off mean=28.2 rms=34.7
Jan 6/7 Full AOS on mean=0.1 rms=13.0
Jan 7/8 Full AOS on mean=0.2 rms=9.7
Jan 8/9 Full AOS on mean=0.2 rms=9.9
doxt [arcsec]
300
250
200
150
100
50
0
-50
-100
-150
-200
0
10
20
30
40
50
60
70
80
ordinal east exposure

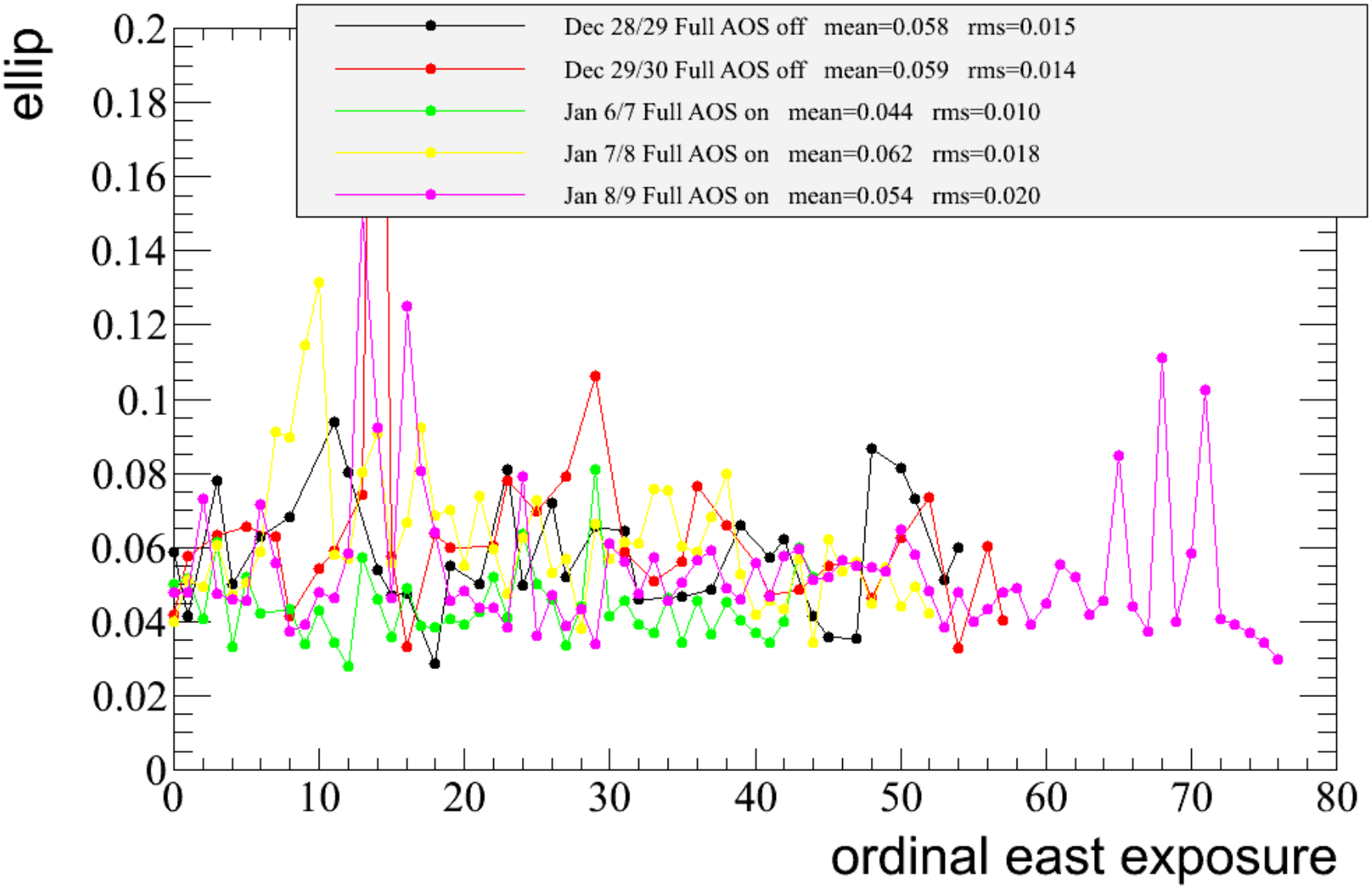
yt (tilt)


Dec 28/29 Full AOS off mean=4.7 rms=22.3
Dec 29/30 Full AOS off mean=-5.5 rms=24.0
Jan 6/7 Full AOS on mean=0.6 rms=13.8
Jan 7/8 Full AOS on mean=-1.4 rms=13.0
Jan 8/9 Full AOS on mean=-0.8 rms=12.0
doyt [arcsec]
300
250
200
150
100
50
0
-50
-100
-150
-200
0
10
20
30
40
50
60
70
80
ordinal east exposure

FWHM (quick reduce)



Ellipticity (quick reduce)



Conclusion

- dz (focus) controlled to 30 micron rms during small slew surveys.
- dx, dy, xt, yt are all significantly better in mean and rms with control on.
- Best ellipticity (means) were with AOS fully enabled but still small statistics.
- Not dramatic but definitely does not make things worse.
- If we enable full aos now, we can continue to improve, otherwise we lock ourselves into “no control” for a very long time.

Propose

- Full AOS on by default.
- A simple gui click to disable.
- A simple gui click to (re) enable.

Details

- Exposures used were all east_commish survey
  - Dec 28/29 – 164388 to 164442
  - Dec 29/30 – 164782 to 164839
  - Jan 6/7 – 166255 to 166299
  - Jan 7/8 – 166741 to 166793
  - Jan 8/9 – 167295 to 167371